Synoptic Analysis (SNAL)

4a. Given centrally produced weather charts, reanalyze to determine the vertical consistency of the atmosphere within 5.0 hours based on a master solution.

Synoptic Analysis (SNAL)

- ATTENTION: Now that you have completed Analysis and Satellite, it is time to begin applying your new found knowledge to an entire set of charts.

- MOTIVATION: In Analysis Laboratory, you will practice your analysis techniques so that you can rapidly and accurately analyze a set of charts.

Synoptic Analysis (SNAL)

- REVIEW: In Dynamics I, II and III you learned the physical principles that govern atmospheric motion. In Physics II you learned to analyze the thickness chart. In Dynamics I you learned the vorticity chart. And height change charts in Dynamics II. In Analysis I you learned to analyze the 300, 500, and 700mb charts. In Analysis II you learned analysis techniques for the 850mb and surface charts. Then finally you finished it off with Satellite.

Synoptic Analysis (SNAL)

- OVERVIEW: In Analysis Laboratory, you will work on chart reanalysis to obtain a reasonable vertical consistency. Reanalysis is in some ways harder and in other ways easier than working with raw data. The basic analysis of contours, isobars and isotherms have already been done for you. It is up to you through reanalysis to ensure that the computer analysis done is correct and **YOUR** analysis has vertical consistency.

Analyze your support charts

- Initialization defined
  - Initialization is actually the second step of a larger processes called the verification/ initialization/ verification (VIV) process. Only the initialization section will be covered in SNAL and the verification portions will be expounded upon in unique.
  - Initialization is used to check and see whether the National Weather Service Produce models are on track with the current synoptic situation.

Analyze your support charts

- Initialization deals only with the 00-hour forecast.

- Physically compare the 00-hour forecast positions with the analysis by using satellite and other real-time data from the same time to see how the 00-hour forecast is doing.

Analyze your support charts

- If the model's initial placement of significant features agrees with the real-time data, then no adjustments are needed and the rest of the model run may be used with confidence. If significant features do not agree with the 00-hour forecast, then obvious adjustments will have to be made and the forecasted prognosis may be suspect.

Analyze your support charts

- Thickness Chart: Analyze the way you were taught in Atmospheric Physics II with the exception of a few color changes.
  - Initialization preparation
    - Outline and shade areas of significant warm air advection red and areas of significant cold air advection blue.
    - Trace the 540 dam thickness line in green.

Analyze your support charts

- Draw the polar front jet axis as a *solid brown line* through the center of the tightest thickness gradient.

- Draw the surface fronts in *brown*. This is a first guess at frontal position. You should not be using the surface chart at this time to place your fronts on the thickness chart.

- Harden in all the highs and lows on the thickness chart in *brown*. **DO NOT** put any other lows or highs on your thickness chart.

Analyze your support charts

- This completes initialization preparation. You will finish the thickness chart when you have completed the reanalysis of surface chart and the 300mb chart.

– Use current thickness chart to classify systems.
– Compare previous thickness chart to current one to see how the surface systems have changed.

Analyze your support charts

- Vorticity: Analyze the way you were taught in Atmospheric Dynamics I with the exception of a few color changes.
  - Initialization preparation.
    - Highlight vorticity maxima (X) in red and minima (N) in blue.
    - Draw advection and shear lobes extending from maxima as *solid brown lines*.
    - Draw advection and shear lobes extending from minima as *zig-zag brown lines*.

Analyze your support charts

- Harden in all the highs and lows on the vorticity chart in *brown*.
- Outline and shade areas of significant PVA red and areas of significant NVA blue.
- Draw the PFJ as a solid brown line through the center of the tightest countour gradient.
- Identify (X) to (N) distribution in a *solid green line*.

Analyze your support charts

- This completes initialization preparation. You will finish the vorticity chart when you have completed the reanalysis of 500mb and the 300mb chart.

– Use current vorticity chart to classify systems.

– Compare previous vorticity chart to current one to see how upper- level systems have changed.

Analyze your support charts

- Satellite Imagery:
  - Analyze satellite imagery for lower and upper level flow features. Use the techniques taught in the satellite unit.
  - Compare the current thickness and vorticity charts to the satellite imagery. Look for discrepancies.

Analyze your support charts

- This procedure will give you a sound idea of what you should be seeing on your charts when you reanalyze them. Use these support charts as a guide for your reanalysis

Chart Identification

- The charts used for reanalysis are prepared by the National Center for Environmental Prediction (NCEP) formally the National Meteorological Center (NMC).
- These charts have a label in the Gulf of Mexico which gives information about the data on the chart.

Chart Identification

- The information is coded as shown below.

LL VV	30 00
TTZDD	12Z20
AAAAA	NGM..
MODEL	SAMPLE

Chart Identification

- LL is the type of data:

  50 = 500 mb
  20 = 200 mb (etc.)
  SF = Thickness
  V = Vorticity

Chart Identification

- VV is the valid time of the forecast. Since we deal only with analyses, in SNAL this will be 00, for a O-hour forecast (analysis).

- TTZDD is the time/date. 12Z20 is 1200 UTC on the 20th of the month.

- AAAAA is the computer program which is used to produce the analysis/forecast. Some common labels are NGM, eta, GC69, OPTIN, and HOUGH.

Chart Identification

- Proper use of chart identification
  - Before beginning any reanalysis, check the time of the charts to be sure they all match.
  - Also, look at the vorticity chart and the 500 mb chart. If they were not produced by the same computer program, they may not show the same pattern--especially over data sparse regions. Satellite imagery is useful for deciding which computer program analysis is better.

Plotted data

- Constant Pressure Charts
  - Generally, the plotted stations on constant pressure charts follow the standard format. A few exceptions to this rule are listed below.

Plotted data

- Aircraft Reports are identified by a square instead of a circle at the station location.
  - The height is given in feet, not meters. For example, 180 = 18,000 feet. This data is plotted on the nearest constant pressure chart. Pilot Reports are generally considered very accurate.
  - THIS DATA MAY BE A SIGNIFICANT DISTANCE ABOVE OR BELOW THE CONSTANT PRESSURE SURFACE. Use the reports carefully.

Plotted data

- Satellite data is identified by a star instead of a circle at the station location.

- Standard plots at 850 mb from locations in the Rocky Mountains (where 850 mb is below ground) have two temperatures plotted.

  - The top temperature is an estimate of the temperature the air at 850 mb would have if 850 mb were not below ground. USE THIS TEMPERATURE.
  - The bottom temperature is the observed surface temperature.

Plotted data

- Standard plots which are enclosed in dotted lines are questionable.

Plotted data

- When using the above described data, remember that it is **YOUR** Job to decide if a report is reasonable or in error.
  - Do not base wild deviations from an otherwise simple pattern on questionable data.
  - Do not draw features based solely on questionable data.
  - If you decide to ignore a station for any reason, circle it in black.

Plotted data

- Surface Chart
  - NCEP surface charts are slightly different from the hand plotted charts used up to this point in the course.
  - The main difference is in the lower right hand corner of the plot where the 6 hour precipitation is given in inches.
  - This is left blank if no precipitation occurred (.00 indicates a trace.)

Plotted data

- Chart Preparation
  - In places where the drawn isopleths on the charts are not true to the data (and the data is "good") re-draw the isopleth correctly.
  - Check the stack of systems carefully. No "stacking" is done by the computer when it analyzes charts.

Plotted data

- If you agree with the height center placed by the computer, color and label it completely as described earlier in Block III.
  - If you disagree with the existence, leave the computer drawn center alone.
  - If you do not agree with the placement, reposition the height center, color and label as described earlier in Block III.
  - If a system is not colored in, we will assume you feel that it isn't there.

Chart Reanalysis

- Reanalysis involves analyzing a stack of upper-level charts which have been analyzed by a computer and a surface chart which has been analyzed by hand.

- The computer smoothes too much, therefore first guess analyses often lacks the detail necessary to produce a good forecast.

Chart Reanalysis

- Reanalyzed charts are prepared the same as hand plotted charts, only there is a first guess of the isobars, contours, isotherms, and isotachs.
  - This can speed up the analysis process since you don't have to start from scratch.
  - It is important, however, to carefully check each and every analyzed line.

Chart Reanalysis

- The computer analysis smoothes isopleths greatly and much of the fine detail is lost. In places where the drawn isopleths are not true to the data (and the data is "good") re-draw the isopleth correctly.

Guidelines for Reanalysis

- 300mb Chart reanalysis
  - **Pencil** in correct contours and isotachs.
  - **Pencil** in jet axis/max. using support charts and satellite as tools.
  - Place lows and highs.
  - Stop! Go to 500mb chart.

Guidelines for Reanalysis

- 500mb Chart Reanalyzes
  - **Pencil** in correct contours and isotherms.
  - **Pencil** in short-wave troughs and ridges using the vorticity chart as a guide.
  - Place lows and highs (make sure they stack with 300mb positions if they appear at 300mb)

Guidelines for Reanalysis

- Place a green dot over the stations with dew-point depression of $\leq$ 5C°.

- Stop! Go to 700mb chart.

Guidelines for Reanalysis

- 700mb Chart Reanalyzes
  - **Pencil** in correct contours and isotherms.
  - Stack short-wave troughs and ridges down from 500mb.
  - Stack lows and highs down from 500mb.

Guidelines for Reanalysis

- Once you are satisfied with your placement of trough/ridges and lows/highs, place the 500 and 700mb, charts on a wall beside each other.
  - Step back about 5 feet and compare your short-wave trough and ridges. Make adjustments as required.
  - You may find more short-wave troughs at 700mb. This is common.

Guidelines for Reanalysis

- Place a green dot over the stations with dew-point depression of $\leq$ 5C°.

- Stop-go to 850mb chart.

Guidelines for Reanalysis

- 850mb Chart Reanalyzes
  - **Pencil** in correct contours and isotherms.
  - Place lows and highs.
  - Stack any short-wave troughs/ridges down from 700mbs.
  - **Pencil** in upper fronts.

Guidelines for Reanalysis

- Place a green dot over stations with dew-point depression of $\leq$ 5C .

- Stop! Go to surface chart.

Guidelines for Reanalysis

- Surface Chart Analysis
  - **Pencil** in correct isobars.
  - Place fronts based on data on the surface chart. Use thickness chart as first guess.

Guidelines for Reanalysis

- Stack surface and 850mb fronts

  - Adjust PFJ axis to show proper stack with surface fronts. (you may have to adjust the front or both).

  - Remember-fronts in mountains are vertically stacked between 850 mb and surface.

  - If you have problems placing fronts in mountains, go to the 700mb chart and do an isotherm analysis. Place upper front at 700 mb on the warm side of the transition zone. Stack the upper front down to 850 mb and surface.

Final Reanalysis

- Check to be sure all the charts and data in the analysis set is consistent. Look very carefully at how your reanalyzes compares to satellite imagery.

Final Reanalysis

- Once you are satisfied with the reanalyzes harden in your charts in the following order.
  - Lows and highs.
  - Troughs and ridges.
  - Finalize moisture analysis.

- Label all contours, isobars, isotherms and isotachs.

- Harden contours, isobars, isotherms and isotachs.

Final Reanalysis

- Final initialization
  - Copy the actual jet axis placement from your 300mb chart over to your thickness chart and vorticity chart in *red*.
  - Copy surface frontal positions and surface highs and lows from your surface chart over to your thickness chart in their original color (red and blue).
  - Copy major and minor short-wave ridges and trofs from your 500 mb chart over to your vorticity chart in *black*.

Final Reanalysis

- Copy closed highs and lows from your 500mb chart chart over to your vorticity chart in *blue and red* respectively.

- There may or may not be differences from the brown positions you originally analyzed on the thickness and vorticity chart to the actual positions you are copying over from the surface, 500mb and 300mb chart. DO NOT try to force positions to match. If positions don't match this shows that the computer models don't have a handle on system placements and that the forecaster needs to be aware of this when putting out the forecast. If gross differences exist, frontal placement may need to be carefully re-thought.

Final Reanalysis

- Review your charts when you are finished to ensure you have not forgotten any features.

- APPLICATION: Students will practice what they have learned during Blocks I, II, and III, by reanalyzing the September 1981 chart sets. Besides reanalyzing the charts, students will take a 20 question appraisal on the charts.

- EVALUATION: Administer the progress check. The progress check consists of a complete stack of charts (300mb through surface, thickness, vorticity, and satellite) dated 1 October 1981, time 12Z. The written test consists of 20 questions from the progress check.

- SUMMARY: In Analysis Lab you have become proficient at reanalyzing a stack of charts to depict a vertical consistent picture of the atmosphere.

- REMOTIVATION: After Dynamics I II and III you have a good understanding of why atmospheric circulatlons exist. After Analysis Lab you have the skills to produce accurate depiction’s of the present state of the atmosphere. You are all set to begin learning how to forecast.

- CLOSURE: As you start to forecast, remember what you have learned thus far and try to build upon it.